Matrices Foundations & Inverse Matrices **Name:** key
Practice w/o graphing calculator

Perform the indicated operation if possible. If not possible, explain why.

1. $\left(\begin{bmatrix} 1 & 2 \\ 0 & -1 \end{bmatrix}-\begin{bmatrix} -3 & -4 \\ 2 & 5 \end{bmatrix}\right)+\begin{bmatrix} 2 & 5 \\ 3 & 9 \end{bmatrix}$

$\begin{bmatrix} 4 & 6 \\ -2 & -6 \end{bmatrix} + \begin{bmatrix} 2 & 5 \\ 3 & 9 \end{bmatrix}$

$\begin{bmatrix} 6 & 11 \\ 1 & 3 \end{bmatrix}$

2. $-3\begin{bmatrix} 1 & 4 \\ -2 & 6 \end{bmatrix}-\left(\begin{bmatrix} 0 & 3 \\ 2 & 6 \end{bmatrix}+\begin{bmatrix} -3 & 2 \\ 5 & -1 \end{bmatrix}\right)$

$\begin{bmatrix} -3 & -12 \\ 6 & -18 \end{bmatrix} - \begin{bmatrix} -3 & 5 \\ 7 & 5 \end{bmatrix}$

$\begin{bmatrix} 0 & -17 \\ -1 & -23 \end{bmatrix}$

3. $\begin{bmatrix} 5 \\ -2 \\ 3 \\ 1 \end{bmatrix}\begin{bmatrix} 1 & 7 \end{bmatrix}$

$4\times1 \quad 1\times2 \quad = 4\times2$

$\begin{bmatrix} 5 & 35 \\ -2 & -14 \\ 3 & 21 \\ 1 & 7 \end{bmatrix}$

4. $\begin{bmatrix} 3 & 1 \\ 4 & -2 \end{bmatrix}\begin{bmatrix} 2 & 1 & 0 \\ 3 & -2 & 4 \end{bmatrix} =$ 2×3

$2\times2 \quad 2\times3$

$\begin{bmatrix} .7 & 0 & .4 \\ -0.1 & 1 & -1.2 \end{bmatrix}$

5. $\begin{bmatrix} 2 & -4 & 0 \\ 0 & 3 & 6 \\ -1 & 5 & 1 \end{bmatrix}\left(\begin{bmatrix} 1 & 2 \\ -3 & 0 \\ 5 & 1 \end{bmatrix}+\begin{bmatrix} 3 & -1 \\ 0 & 2 \\ 4 & 5 \end{bmatrix}\right)$

$\begin{bmatrix} 2 & -4 & 0 \\ 0 & 3 & 6 \\ -1 & 5 & 1 \end{bmatrix}\begin{bmatrix} 4 & 1 \\ -3 & 2 \\ 9 & 6 \end{bmatrix} =$

$3\times3 \quad 3\times2$

$\begin{bmatrix} 20 & -6 \\ 45 & 42 \\ -10 & 15 \end{bmatrix}$

3×2

6. The senior class play was performed on three different evenings. The attendance for each evening is shown below. Adult tickets sold for $3.50 and student tickets sold for $2.50. Use matrix multiplication to determine how much money was taken in each night.

	Adults	Students
Opening Night	420	300
Second Night	400	450
Final Night	510	475

TOTAL

$$\begin{bmatrix} 420 & 300 \\ 400 & 450 \\ 510 & 475 \end{bmatrix}\begin{bmatrix} 3.50 \\ 2.50 \end{bmatrix} = \begin{bmatrix} 2220 \\ 2525 \\ 2972.5 \end{bmatrix}$$

The opening night took in $2220.00, the second night $2525 and the final night $2972.50.

7. Solve for x and y:

$$2\begin{bmatrix} 2x & 0 \\ 3 & -3y \end{bmatrix} = \begin{bmatrix} -12 & 0 \\ 6y & -6y \end{bmatrix}$$

TYPO! change to

$$\begin{bmatrix} 4x & 0 \\ 6 & -6y \end{bmatrix} \quad \begin{bmatrix} -12 & 0 \\ 6y & -6y \end{bmatrix}$$

$4x = -12$

$x = -3$

$y = 1$

8. Solve for x and y.

$$3\begin{bmatrix} 3 & -2x \\ 2 & 4 \\ -y & 2 \end{bmatrix} - \begin{bmatrix} 2 & -2x \\ 0 & 5 \\ -2y & -2 \end{bmatrix} = \begin{bmatrix} 7 & 8 \\ 6 & 7 \\ 0 & 8 \end{bmatrix}$$

$$\begin{bmatrix} 9 & -6x \\ 6 & 12 \\ -3y & 6 \end{bmatrix} - \begin{bmatrix} 2 & -2x \\ 0 & 5 \\ -2y & -2 \end{bmatrix} = \begin{bmatrix} 7 & 8 \\ 6 & 7 \\ 0 & 8 \end{bmatrix}$$

$-6x + 2x = 8 \qquad -3y + 2y = 0$

$-4x = 8 \qquad -y = 0$

$x = -2 \qquad y = 0$

9. Solve for x and y.

$$\begin{bmatrix} 1 & 2 & -1 \\ 3 & -2 & 1 \\ 0 & 2 & 4 \end{bmatrix}\begin{bmatrix} x \\ 2 \\ -1 \end{bmatrix} = \begin{bmatrix} 8 \\ y \\ 0 \end{bmatrix}$$

$x + 4 + 1 = 8$

$x + 5 = 8$

$x = 3$

$3x - 4 - 1 = y$

$3x - 5 = y$

$3(3) - 5 = y$

$4 = y$

only mult what you need!

10. Are the two matrices inverses of each other? How do you know?

$$\begin{bmatrix} 3 & 2 \\ 4 & 2 \end{bmatrix} \text{and} \begin{bmatrix} -1 & 1 \\ 2 & -\frac{3}{2} \end{bmatrix}$$

I

$$\begin{bmatrix} 3 & 2 \\ 4 & 2 \end{bmatrix}\begin{bmatrix} -1 & 1 \\ 2 & -\frac{3}{2} \end{bmatrix} = \begin{matrix} -3+4 & 3-3 \\ -4+4 & 4-3 \end{matrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

Yes because when the matrices are multiplied they equal the identity matrix

Practice w/a graphing calculator

11. Solve the matrix equation: $\begin{bmatrix} 1 & 2 \\ 2 & 3 \end{bmatrix} X = \begin{bmatrix} 4 & -1 \\ 5 & 2 \end{bmatrix}$

$A \quad X = B$

$X = A^{-1}B$

$$X = \begin{bmatrix} -3 & 2 \\ 2 & -1 \end{bmatrix}\begin{bmatrix} 4 & -1 \\ 5 & 2 \end{bmatrix}$$

$$X = \begin{bmatrix} -2 & 7 \\ 3 & -4 \end{bmatrix}$$

12. Solve the matrix equation: $\begin{bmatrix} 3 & -4 \\ 4 & -6 \end{bmatrix} X = \begin{bmatrix} 1 & -3 & 4 \\ -2 & 0 & 6 \end{bmatrix}$

$$X = \begin{bmatrix} 3 & -2 \\ 2 & -\frac{3}{2} \end{bmatrix}\begin{bmatrix} 1 & -3 & 4 \\ -2 & 0 & 6 \end{bmatrix}$$

$$X = \begin{bmatrix} 7 & -9 & 0 \\ 5 & -6 & -1 \end{bmatrix}$$

13. Use an inverse matrix to solve the system:

$4x - y = 10$

$-7x - 2y = -25$

Matrix equation

$A \quad X = B$

$$\begin{bmatrix} 4 & -1 \\ -7 & -2 \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 10 \\ -25 \end{bmatrix}$$

$X = A^{-1} B$

$$\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} \frac{2}{15} & -\frac{1}{15} \\ -\frac{7}{15} & -\frac{4}{15} \end{bmatrix}\begin{bmatrix} 10 \\ -25 \end{bmatrix}$$

$$\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 3 \\ 2 \end{bmatrix}$$

$(3, 2)$

14. Use an inverse matrix to solve the system:

$$x - y - 3z = 2$$
$$5x + 2y + z = -17$$
$$-3x - y = 8$$

$$\begin{bmatrix} 1 & -1 & -3 \\ 5 & 2 & 1 \\ -3 & -1 & 0 \end{bmatrix}\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 2 \\ -17 \\ 8 \end{bmatrix}$$

A^{-1}

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 1 & 3 & 5 \\ -3 & -9 & -16 \\ 1 & 4 & 7 \end{bmatrix}\begin{bmatrix} 2 \\ -17 \\ 8 \end{bmatrix} \qquad (-9, 19, -10)$$

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} -9 \\ 19 \\ -10 \end{bmatrix}$$

He made 99 3pt shots, 1316 2pt shots and 371 free throws.

15. During the 2003-2004 NBA season, Dirk Nowitzki of the Dallas Mavericks made a total of 976 shots and scored 1680 points. His shots consisted of 3-point field goals, 2-point field goals, and 1-point free throws. He made 135 more 2-point field goals than free throws. Use an inverse matrix to find how many of each type of shot he made. Use Cramer's rule

x = 3pt fg
y = 2pt fg
z = 1pt ft

$x + y + z = 976$ ← TOTAL # SHOTS

$3x + 2y + z = 1680$ ← TOTAL # PTS

$z + 135 = y$
or $-y + z = -135$

coeff matrix

$$\begin{bmatrix} 1 & 1 & 1 \\ 3 & 2 & 1 \\ 0 & -1 & 1 \end{bmatrix}_{3\times3}\begin{bmatrix} x \\ y \\ z \end{bmatrix}_{3\times1} = \begin{bmatrix} 976 \\ 1680 \\ -135 \end{bmatrix}_{3\times1}$$

$$|A| = \begin{vmatrix} 1 & 1 & 1 \\ 3 & 2 & 1 \\ 0 & -1 & 1 \end{vmatrix} = -3$$

$$x = \frac{\begin{vmatrix} 976 & 1 & 1 \\ 1680 & 2 & 1 \\ -135 & -1 & 1 \end{vmatrix}}{-3} \qquad y = \frac{\begin{vmatrix} 1 & 976 & 1 \\ 3 & 1680 & 1 \\ 0 & -135 & 1 \end{vmatrix}}{-3} \qquad z = \frac{\begin{vmatrix} 1 & 1 & 976 \\ 3 & 2 & 1680 \\ 0 & -1 & -135 \end{vmatrix}}{-3}$$

$$\frac{-297}{-3} \qquad = \frac{-3948}{-3} \qquad = \frac{-1113}{-3}$$

$x = 99$ $\qquad y = 1316$ $\qquad z = 371$